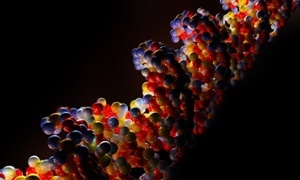
The case for genetically engineered babies

Whoever first crosses the line to edited embryos will find a powerful new resource in the fight against disease. What we ought to do is use it responsibly

[[](http://www.theguardian.com/science/2015/may/01/fear-of-designer-babies-shouldnt-distract-us-from-the-goal-of-healthy-babies#img-1)](http://www.theguardian.com/science/2015/may/01/fear-of-designer-babies-shouldnt-distract-us-from-the-goal-of-healthy-babies" \l "img-1)

 An illustration of a DNA strand. We know that some genes are bad in nearly every conceivable environment; do we lose anything by editing them out of the human lineage? Photograph: Zoonar GmbH/Alamy

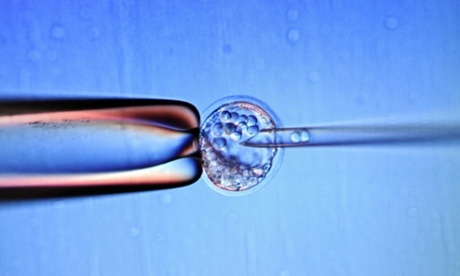
**Christopher Gyngell**

Christopher Gyngell is a bioethicist from the University of Oxford

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The [first study](http://link.springer.com/article/10.1007/s13238-015-0153-5/fulltext.html) to modify the genes of a human embryo, conducted at Sun Yat-sen University in China, has caused a furious backlash. *Nature* and *Science,* the world’s most prestigious scientific journals refused to publish the study, at least partly on ethical grounds. Instead they [published](http://www.nature.com/news/don-t-edit-the-human-germ-line-1.17111) [commentaries](http://www.sciencemag.org/content/348/6230/36) calling for such research to be stopped. On Wednesday, the US government’s National Institutes of Health (NIH) restated their [position](http://www.nih.gov/about/director/04292015_statement_gene_editing_technologies.htm) that it will “not fund any use of gene-editing technologies in human embryos.” The NIH views such editing of the “germline” in human embryos as “a line that should not be crossed*.”* The stance will essentially stifle any research on gene editing in embryos in the US.

The ultimate goal of gene editing technologies is the capacity to make precise, controlled modifications to very specific areas of the genome. This would be a powerful ability. Gene editing unlocks access to an entirely novel way to fight disease which has been unreachable until now.



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Around 7.9 million children each year are born with a serious birth defect that has a significant genetic contribution. If we could safely and easily correct these errors at the embryonic stage it would be possible to virtually eradicate this disease burden. In addition, 30% of all deaths worldwide are due to chronic diseases (such as heart disease, cancer, and diabetes) in those under 70. We all know of people who seem innately resistant to the perils of ageing and flourish well into their 80s and 90s. Gene editing could ensure we all have the best chance to live healthily into old age.

There are many challenges we must overcome to access the benefits of gene editing. The first and foremost is safety. Under agreed global research ethics standards, no experiments should be conducted where there is a high risk of harm to the participant, and a low chance of benefit. Gene editing is a long way from overcoming this barrier. Current techniques are imprecise, and lead to widespread damage to the genome. It would be highly unethical if a child was born whose genome was edited with current techniques.

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However, we can still perform important research with current gene editing technologies in ways which harm no one. The pioneering Chinese study was performed entirely on abnormal, unviable IVF embryos that could never result in a live birth. Gene editing techniques could be greatly advanced by experiments conducted entirely in petri dishes, with embryos that would otherwise be destroyed and in accordance with existing regulations. The UK has a comprehensive and well-established regulatory framework for embryo research, including provisions that only embryos under 14 days old be used. This framework has successfully guided research involving embryos for over two decades.

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Many fear that such research will lead us on a path to “designer babies”. People shudder at the thought of parents picking and choosing the genes of their children, just as they pick and choose the accessories for their nurseries. And we have good reasons to be concerned about this prospect. Widespread access to gene editing technologies could harm children and damage the gene pool. Genes fashionable in one generation may prove to be harmful in the next. In addition, parental control of the gene pool could reduce valuable forms of diversity. If every parent picks the same immunity genes for their children, it may make them collectively as vulnerable to pathogens as 19th century Irish potatoes.

But a fear of designer babies should not distract us from the goal of healthy babies. We know that some genes are bad in nearly every conceivable environment. There is no possible way that the gene which causes [Tay-Sachs disease](http://www.nhs.uk/Conditions/Tay-Sachs-disease/Pages/Introduction.aspx) - a disease in which children develop normally for six months and then become progressively deaf, blind, unable to swallow, and paralytic, before dying at four - will benefit future generations. We lose nothing by editing this gene out of the human lineage.

There is no reason why we couldn’t restrict the use of gene editing technologies to removing valueless genes like this. For over two decades we have successfully used IVF and pre-implantation diagnosis (PGD) in this way. Regulations restrict the use of these technologies to the prevention of disease. Similar regulations could restrict gene editing technologies to therapeutic uses.

Some see unpredictable consequences, rather than designer babies, as the key risk in crossing the line to edited embryos. They see meddling with our genome as inherently dangerous – no matter which genes we target. Just dipping our toes in the gene pool will cause large ripples. These ripples will cause chaotic and uncontrollable consequences. According to this view it would be far wiser not to dip our toes in at all.

But the gene pool is a violent ocean rather than a peaceful pond. The human germline is in a constant state of flux. Every new birth adds [new genetic variants](http://www.sanger.ac.uk/about/press/2011/110612.html), and each death removes some. Many permitted human activities, like delaying paternity, add to this chaos by [increasing the number](http://www.nature.com/articles/nature11396.epdf?referrer_access_token=FbFXQzd-sx1zej__6VXyAdRgN0jAjWel9jnR3ZoTv0NCpm6i6TDMlXsjV9vwYu6OcE_jUACT1mGw48obI9i0-m80XkihLW9sRiKyR1x6ZNvVdOGKM-oYSV6EjtH0IffV1s08QYZcLMhzd7A4l5Yg3MfVIZIoQoA_Br0V09qvm7E8lFw3SGawdkPTVFdpnIGoF4W9nXGBH6tRFrBdNPkdMw%3D%3D&tracking_referrer=www.nature.com) of random mutations in the germline. Any ripples caused by targeted therapeutic gene editing will likely be dwarfed by other factors.

No matter what is done in the UK, the line to edited embryos and intentional germline modifications will be crossed soon. In the US, work can go ahead with funding from foundations, charities, companies or private individuals. China will race ahead. Others will likely follow. If we want gene editing research to be done in a responsible way, we need countries with good regulatory systems leading the charge. The UK is one such country, where the Human Fertilisation and Embryology Authority can provide reassurance that no research or application proceeds without proper evaluation.

Whoever first crosses the line to edited embryos will find a powerful new resource in the fight against disease. Like many resources there are risks associated with its use. Indeed the risks are very high. However ignoring the resource is also risky. We may needlessly subject future generations to an endless cycle of suffering and disease.

What we ought to do is use this resource responsibly. We should harness its power to achieve good ends and restrict its use for purposes that are bad. This will not be achieved by simply withdrawing from research. It’s time to mount a responsible expedition across the line to edited embryos and the UK should lead the way.